UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III

841 Chestnut Building
Philadelphia, Pennsylvania 19107-4431

Ms. Betty L. Serian
Deputy Secretary for Safety Administration
Pennsylvania Department of Transportation
Room 1200
Transportation & Safety Building
Harrisburg, Pennsylvania 17120

MAR 28 1996

Dear Ms. Serian:

Please find enclosed comments from the Environmental Protection Agency (EPA) regarding Pennsylvania's proposed inspection and maintenance (I/M) program. These comments stem from our review of the January 25, 1996 version of a draft Commonwealth I/M SIP and accompanying regulation.

A complete list of EPA's comments from our review of the draft SIP package, ordered according to EPA's I/M Requirements Rules, is enclosed with this letter. A detailed description of a few of those concerns is found below. These concerns, in particular, must be addressed before EPA can fully approve Pennsylvania's program under the EPA I/M Rule Requirements Regulation:

The Clean Air Act requires that compliance with the I/M program (by motorists) be enforced through a system of registration denial, unless the state has an existing alternative that has been demonstrated to EPA to be more effective. Pennsylvania has not made such a demonstration to justify the current sticker enforcement program. Instead the SIP contains a statement that "sticker enforcement is more effective than registration denial". EPA has set forth a clear process for such a demonstration in its I/M Program Requirements Rule. Furthermore, Pennsylvania statute limits the maximum penalty for motorists operating vehicles without a valid sticker to a $25 fine per violation, versus a potential cost to a complying motorist of the emission test fee + the cost of associated repairs, up to the waiver limit.

The draft SIP does not include a program implementation schedule, indicating dates by which: testing will begin for each program, RFPs will be issued to contract out key program functions, contractors are to be hired, stations must be licensed/must obtain equipment, etc.

Also, the SIP does not include provisions to protect the public from potential fraud and abuse by inspectors, mechanics, or others involved in the I/M program. Neither does it provide consumers an avenue for obtaining referrals of qualified repair technicians, or for a station's repair effectiveness performance.

Pennsylvania's draft regulation requires that the final waiver limits be fully phased-in by start

of the third testing cycle. If Pennsylvania's program is implemented in mid-1997, the full wavier limit would not begin until at least mid-1999. For areas where testing is to begin in 1999, final waivers would not be in place until at least 2001. Additionally, under the draft SIP, waivers may be issued by any participating test inspector, thus removing any quality control on issuance of waivers.

The draft regulation requires a data link between station test analyzers and a PennDOT contractor's computer, and the draft PA SIP states that stations must periodically send data transmissions. Pennsylvania has not satisfied the EPA requirement that test data be transmitted via a real-time data link. A real-time, bi-directional link serves to reduce the possibility of consumers "shopping around" for initial passing test at different stations or improper entry of that data element by a test station, which can in turn, improve the accuracy of the compliance rate determined for the program.

Finally, while the penalties against stations and inspectors in the Commonwealth's regulatory penalty schedule are adequate, the draft regulation establishes a "point system", which can be used to settle violations in lieu of suspension. Under this system, points would fade over time and suspensions/fines would not be imposed until a minimum limit is reached. This point system allows even serious offenses to occur one or more times, without imposition any fine or even a single day of suspension.

Each of these program aspects differs from Federal I/M requirements, and is not supported by the flexibility granted for I/M programs under the National Highway Systems Act of 1995. I would welcome the opportunity to meet with you or your staff to discuss means of addressing these inconsistencies. I am aware that some of these issues may be topics of discussion for the stakeholders' process established by Governor Ridge. I would like to take this opportunity to thank you for working diligently to meet the stringent deadlines under the National Highway Systems Act, and for providing EPA with the opportunity to provide comments on a preliminary draft version of the SIP.

Sincerely,

Marcia L. Spink for

Thomas J. Maslany, Director
Air, Radiation & Toxics Division

Enclosure

# COMMENTS ON THE PENNSYLVANIA I/M SIP, ORDERED ACCORDING TO EPA I/M REGULATIONS

## §51.350, Applicability

- PA SIP should contain a list of zip codes for all areas subject to I/M

- The I/M regulation should convey that the entire county is subject to the program [perhaps under the definition for "subject area"]. The SIP narrative should also address the eight counties exempted from the Pennsylvania I/M program which are part of a subject MSA, but which because of their population density of under 200 persons per square mile (and since they comprise less than 50% of the MSA), are exempted from the program.

- The SIP narrative should discuss that the I/M program does not have a sunset date. The SIP could cite the legal authority to adopt an I/M program that does not sunset at some future date.

## §51.351, Enhanced I/M Performance Standard

- The SIP narrative should include a list of those measures which Pennsylvania is adopting to alleviate the shortfall between centralized and decentralized program credits. Per the National Highway Systems Act, these measures need not be quantified at this time. However, this listing serves to group those measures which distinguish the enhanced program from Pennsylvania's current 11-county program, even if those measures are included separately elsewhere in the SIP.

- The "Enhanced I/M Performance Standard" section of the SIP narrative (p. 13) states that modeling characteristics for the program include functional pressure and purge testing of 1981 and newer model year vehicles (presumably for the entire state). However, this testing is not possible in the low-enhanced areas of the Commonwealth that will utilize BAR 90 test analyzers. Additionally, functional evaporative testing was not modelled for those areas. The network type and/or performance standard sections of the SIP should describe the test type (i.e. ASM w/ pressure & purge and a visual component inspection), for different weight classes and model years of vehicles, for each of the different program areas (i.e. the "high-enhanced" versus the "low-enhanced" programs.)

- The MOBILE modeling runs for the high-enhanced testing areas assume testing begins in January 1995, not the 1997 start date cited in the SIP narrative's description of the enhanced performance standard. Modeling should assume a later start date.

  Additionally, for the Pittsburgh counties (centralized runs), ATP is assumed to begin in 1995, and for the Allentown counties ATP is modeled starting in 1998.

- The performance standard for the enhanced counties was modeled using idle testing instead of 2-speed idle testing (see the first I/M line in the MOBILE performance standard in the SIP appendix). This mistake was not repeated in the runs for the proposed program.

**§51.352, Basic I/M Performance Standard**

- Not Applicable

**§51.353, Network Type & Program Evaluation**

- EPA's I/M Rule, codified at 40 CFR Part 51.353(c)(3) requires that the program evaluation be performed using transient, *mass-based* testing. Section D of the SIP narrative states that the program evaluation will consist of oversight of official inspection station inspectors' performance of calibration of test equipment and of the testing, itself (using test equipment required for that particular subject area). EPA's proposed OTC Flexibility Rulemaking allows areas utilizing that approach to eliminate the program evaluation criteria. It is unclear in the SIP whether evaluation testing is to be performed in all subject areas. But, under this SIP, evaluation data could presumably consist of BAR90 test results and ASM test results (in addition to pressure/purge and/or ATP test results).

- Section D(A)of the SIP (p.16) states that EPA's policy under the National Highway Systems Act precludes a network type description. While the SIP need not include an "equivalency demonstration", per the I/M Rule, the SIP should include a description of the network design. At the very least, the network description serves to inform the public about the various testing requirements, including, for example, where and how often testing will be needed.

- The SIP narrative does not address Pennsylvania's legislative authority to conduct a program evaluation, as required under 40 CFR Part 51.353. However, since the evaluation described in the SIP merely includes observation of actual tests, in inspection station bays, it would appear that no additional legal authority is needed to perform the tests. The SIP should describe the Commonwealth's legal authority to contract with a private vendor to perform the evaluation process, and should include a schedule for this process. The SIP does not commit to conduct a program evaluation, as required under the National Highway Systems Designation Act, or to submit the results of that evaluation to EPA at the end of the interim approval period set forth in that legislation.

- The SIP narrative should include a description of the schedule for the evaluation schedule and protocol. Although this task need not be completed prior to interim approval under the National Highway Safety Act, it must be completed in the final version of the Commonwealth's SIP before full approval can be granted. Also, the resources and personnel (or contractor resources) to be allocated to program evaluation must be specified in the final SIP.

- The SIP narrative does not have a specific section listing those measures which allow the proposed decentralized program network design to meet the performance standard (based on test-only testing).

Per EPA's December 12, 1995 policy memo and the National Highway Safety Act, these measures must be listed separately in the SIP, even if they are included in the SIP separately.

- Section D of the PA SIP only requires that an analysis of the evaluation data be submitted to EPA, and not the actual data. EPA's I/M rule requires that this data be submitted, as well as an analysis of that data. Also, EPA's I/M Rule requires that this data be used to determine local fleet emission factors and to assess actual program effectiveness. The Commonwealth's SIP does not address these uses of evaluation data.

**§51.354, Adequate Tools and Resources**

- Pennsylvania does not have dedicated funding for oversight of the I/M program, but instead relies upon PennDOT general funds (as appropriated annually by the state legislature.) Although the SIP states that PennDOT is seeking legislative amendments to allow for an application fee to potential test facilities and a sticker purchase fee to motorists (and a dedicated fund for those fees), the SIP does not address whether these sources would provide adequate funding. The SIP states that administrative oversight of the program is to be conducted by current PennDOT staff, but does not include estimates of staff and resources needed to perform those functions.

- The SIP narrative does not provide that PennDOT currently has or will have a dedicated funding source, or authority to allow the Commonwealth to contract with private vendors to conduct various functions under the I/M program (i.e. the remote sensing, program management, quality assurance, and data collection portions of the program).

- Under the proposed program, the Commonwealth would not receive any portion of the testing fee. Section 51.354 of the CFR Part 40 clearly requires that states provide that a the program will maintain a funding source to ensure adequate program oversight, management and capital expenditures. The SIP, in its present form, lacks a detailed budget plan for both personnel and equipment resources and a mechanism to ensure future funding of the program..

**§51.355, Test Frequency and Convenience**

- Section F of the PA SIP states only that subject vehicles must pass an annual emissions test before a safety inspection can be performed. The SIP does not clearly address public testing notification schedules. §177.51(3)of Pennsylvania's proposed regulation requires annual testing, but does not specify the mechanism or when motorists will be notified of the emissions testing requirement. Nor is there a description in the SIP of the internal process for issuing motorist notification of testing requirements.

- 40 CFR Part 51.355 requires that sufficient safeguards be built into the enforcement system to ensure that vehicles will be tested according to the state's schedule. Pennsylvania's SIP does not call for the use of computer matching or any registration-linked mechanism to ensure that motorists comply with testing

requirements in a timely manner. 75 Pa. C.S. §4703(h) limits the fine for operating a subject vehicle without an inspection sticker to $25, and Pennsylvania's regulations do not include late fees for motorists failing to receive a test by any specific deadline.

**§51.356, Vehicle Coverage**

- The PA SIP text does not contain an estimate of the number (as of time of submittal) of subject vehicles, or a breakdown of those subject to the "high enhanced" Philadelphia program vs the "low enhanced" program, for the remainder of the state. Appendix A-2 of the SIP text provides 1994 estimates of the number of subject vehicles in the 25 subject counties. This table lists passenger cars and LDGT1 and LDGT2 vehicles. The "Definitions" section of PA's regulation lists light-duty trucks as trucks weighing less than 6,000 lbs, but contains no definition for a heavy-duty truck. However, the regulation also subjects trucks up to 9,000 lbs GVWR to testing. This makes it difficult to interpret subject weight classes. If Pennsylvania does not have a registration-defined weight class cutoff for trucks less than 6,000 lbs GVWR, the mechanism for including subject heavy-duty trucks is unclear.

- The SIP does not provide an estimate of unregistered vehicles that are required to be registered in a program area (in addition to the total number of registered vehicles in subject areas).

**§51.357, Test Procedures and Standards**

- For the idle testing procedure of the program, §177.203(a) and (b) of Pennsylvania's I/M regulation adopts federal idle test procedures by incorporation by reference from 40 CFR Part 51, subpart S, Appendix B(I). However, the I/M modeling in the appendix of the SIP assumes 2-speed idle testing of 1975 and newer vehicles in low-enhanced areas (idle testing of 1968-1974 vehicles). PA does not cite 40 CFR Par 51, Subpart S, Appendix B(2) for the federal 2-speed idle test procedure.

- Neither pressure nor purge evaporative test procedures are included or referenced in the regulations or in the SIP narrative. However, both pressure and purge testing is assumed in the performance standard modeling for the Philadelphia areas. This modeling assumes two additional model years of vehicles will be subject to pressure testing (1981 vs 1983) and five additional model years of vehicles subject to purge testing (1981 va 1986), compared to EPA's performance standard. Pressure and purge procedures must be properly incorporated by reference in Pennsylvania's regulation, if they are to be utilized in final I/M program design.

- §177.203 of the regulation references EPA's draft procedures for ASM testing (for incorporation by reference from 40 CFR Part 85) upon completion by EPA. EPA cannot fully approve Pennsylvania's SIP until this procedure is finalized and incorporated in Pennsylvania's regulation.

- Pass/fail standards for all test procedures for all subject model years of vehicles must be included in the SIP. §177.204 of the Pennsylvania regulation states standards for idle testing, and reserves a section for ASM testing standards. Pressure/purge fail cutpoints are not provided, nor is there a section of the

regulation reserved for their inclusion. Performance standard modeling must be re-modeled to reflect these final cutpoints.

- The SIP should include a schedule, with annual deadlines, by when Federal installation managers are required to show proof of inspections for employee-owned vehicles operated on Federal installations. The SIP should also included sample documentation to be used by Federal installation managers to meet this requirement.

- The Commonwealth's regulation does not require that all criteria pollutants be measured upon retesting (not simply the pollutant that caused a failure), after a vehicle is failed for a given pollutant.

**§51.358, Test Equipment**

- §177.202(c), (d), and (e) of PA's regulation incorporate by reference (via the appropriate CFR references ) EPA's test procedures for transient (upon finalization of final ASM specs), idle, and 2-speed idle equipment. No technical specifications have been provided or referenced for evaporative emissions testing. Final test equipment specifications must be incorporated in the Commonwealth's final SIP/regulation.

- §177.202(b)(2) requires a data link to PennDOT computers (as specified by the Department). Section 1 (p. 3) of the PA SIP states that a contractor will be responsible for data collection through periodic data transmissions. Pennsylvania has not satisfied the requirement that test data be transmitted via a real-time data link.

- Further detail regarding the data collection contractor must be provided in the final SIP. This should include the RFP and the contract for that vendor. Additionally, the SIP narrative should fully address that contractor's responsibilities and the funding mechanism for payment under a contract.

**§51.359, Quality Control**

- Quality assurance procedures must be developed and included in the final SIP. All quality control requirements from 40 CFR 51.359 must be addressed. Since quality control is to be primarily the responsibility of a private vendor, the SIP narrative should fully address that contractor's responsibilities and the funding mechanism for payment under a contract.

**§51.360, Waivers & Compliance via Diagnostic Inspection**

- Per EPA's I/M Flex Rule, waiver limits may be phased-in by states, with full waiver limits (per the Clean Air Act) beginning January 1, 1998. §177.282 of the Pennsylvania regulation requires that the final waiver be $450 + CPI adjustment (from 1989), beginning with the third year (cycle) of testing. If Pennsylvania's program is implemented in mid-1997, the full wavier limit would not begin until at least

mid-1999. For those areas beginning testing in 1999, final waivers would not be in place until beginning at least 2001.

- The Commonwealth's regulation allows emission station inspectors to grant waivers directly to motorists. This directly conflicts with the quality control provisions for waivers in 40 CFR 51.360(c), which allows states to delegate waiver issuance to a single contractor, but not directly to test station inspectors.

- 67 PA §177.281(5) allows diagnostic waivers for "transient" tested vehicles. According to the definitions section of the regulation, "transient testing" is expanded from Federal definitions [40 CFR 51.360(8) only allows diagnostic waivers for vehicles undergoing IM240 testing, using EPA's recommended cutpoints]. Pennsylvania's definition allows ASM to be defined as a transient test, although it is actually a loaded steady-state test. EPA's regulations do not support the use of ASM testing to grant diagnostic waivers.

**§51.361, Motorist Compliance Enforcement**

- Section 182(c)(3)(C)(iv) of the Clean Air Act requires states to utilize registration denial enforcement, unless the state has an existing alternative measure and demonstrates to EPA's Administrator that this measure is more effective than registration denial. Pennsylvania has not made such a demonstration in its SIP to justify the continuation of its sticker enforcement program. Instead, Section L of the SIP merely contains merely a statement that "PA's sticker enforcement program is more effective than registration denial enforcement". 40 CFR 51.361 sets forth requirements that must included in this demonstration to be approvable by EPA.

- §178.651 of Pennsylvania's regulation refers to PennDOT's quality assurance personnel or other authorized personnel, as those issuing violations under that section. This is the only regulatory reference to enforcement personnel. The SIP should specify that state police and quality assurance contractor personnel (if applicable) will serve as enforcement staff.

- The SIP does not contain an expected compliance rate or the current compliance rate for the existing program (accounting for loopholes, counterfeiting, unregistered vehicles, stolen stickers, etc). The SIP should include this analysis (based upon actual data), accompanied by a discussion of how the estimate was derived. The SIP should also include estimates of the effect of closing these loopholes, and otherwise improving the sticker enforcement mechanism. This is particularly important for the Commonwealth, since improved effectiveness is touted as a measure to justify the network design under the National Highway Systems Act.

- The I/M program should use an external, easily visible and unambiguous identification of subject vehicles' compliance status. While Pennsylvania's I/M sticker identifies the vehicle's compliance, it does not identify whether a vehicle passed or received a waiver, nor can it alone identify subject vehicles which are subject to testing, but have never received a test.

- 75 C.S. §4703(h) establishes a penalty for persons operating a vehicle without an emissions inspection of $25 per violation. This penalty should reflect (at a minimum) the upper cost limit of non-compliance, or the $450 waiver cost (adjusted to CPI) + a typical test fee.

- The Commonwealth should perform surveys involving at least 10% or 10,000 (whichever is less) of subject vehicles, to verify compliance. Section L of Commonwealth's draft SIP narrative (p. 33) contains a commitment to conduct parking lot surveys if effectiveness drops below 96%. However, no mechanism to track actual effectiveness is included, nor is there a commitment to perform surveys on 10% of the subject population.

**§51.362, Motorist Compliance Enforcement Program Oversight**

- Section M of Pennsylvania's draft SIP narrative commits to contract with a private vendor charged with developing a quality assurance procedures manual. Additionally, this contractor is to enforce quality control (e.g. performance of covert/overt audits) -- with State Police issuing violations. The quality assurance procedures manual must be included in the final Pennsylvania SIP. 40 CFR 51.362 contains specific requirements for enforcement oversight which must be addressed in Pennsylvania's SIP. Additionally, the RFP and/or contract for the quality assurance contractor should be provided

- The final SIP should also describe information management activities/procedures for the program. Since data collection and information management for the program will be the responsibility of a private vendor, information on the RFP and contract should also be included.

**§51.363, Quality Assurance**

- The quality assurance procedures manual (to be developed by a private vendor), should be submitted upon its completion as part of the final SIP. This procedures manual should address the requirements of 40 CFR 51.363.

- The frequency of both overt and covert performance audits, based on the number of inspection stations and inspectors, should be provided in the SIP, possibly to be included in the QA procedures document.

- The SIP narrative should contain a description of the partnership with the state police for issuance of NOVs and any auditing responsibilities. This should include a description of the state police resources that are to be dedicated to these tasks -- possibly to include the legal authority to make use of the police for this function.

- If performance audits are to be the joint responsibility of the Department and a private vendor, the SIP should describe the responsibilities of each, in detail, and the resources (personnel and financial) to be devoted to each.

## §51.364, Enforcement Against Contractors, Stations and Inspectors

- While the penalties against stations and inspectors in the Commonwealth's regulation penalty schedule are adequate, §177.602(b) of PA's regulation allows stations to accept a "point system" assessment, in lieu of suspension (if the station owner was without knowledge of the violation). Points are reduced over time (at the rate of 2 per year) and suspensions/fines are not doled out until a minimum point limit is reached. This point system allows even serious offenses to occur, one or more times, without imposition of even a single day of suspension or any fine. This is an unacceptably lenient method of avoiding adjudication of hearings.

- §177.652 of the Commonwealth's regulation states that PennDOT "may order the surrender, upon demand" of licenses, inspection documents, signs, records, etc. from suspended station owners or inspectors." However, confiscation is clearly at the discretion of PennDOT personnel. To prevent involvement in emissions testing during suspension periods, the rule must require the confiscation of these testing materials.

- §177.651 of the PA regulation provides the opportunity for a Department hearing, within 14 days of a request, upon issuance of suspension to a station or inspector. Section O (p. 38) of the SIP narrative seems to provide that penalties are not imposed until a requested hearing is held. EPA's regulations requires that suspension authority be **immediate** upon discovery of a violation or equipment failure, and that hearings be held in three business days. If this authority is prohibited by state constitution, the SIP should cite this authority.

- The SIP should require the Department to maintain records of all enforcement activities (including all warnings, civil fines, suspensions, revocations, and violations). This should be included in the QA procedures document in the SIP. This data should then be used to compile and report annually to EPA statistics on enforcement activities.

## §51.365, Data Collection

- The Commonwealth's SIP and regulation do not require inspectors to enter/collect data on a vehicle being tested. There is only a requirement that test equipment be designed to accept certain data elements and that data be collected in accordance with EPA requirements. The SIP should state what data is to be entered into the analyzer by the inspector (not just that data will be collected in accordance with EPA regulations, as the SIP text states).

- There is no regulatory requirement that the analyzer be required to record: quality control check information, lockouts, attempted tampering with the analyzer, and other recordable quality control info related to the analyzer (e.g. service calls).

## §51.366, Data Analysis and Reporting

- The SIP states that data analysis and submission of test data reports to EPA are to be the responsibilities of a private vendor. The RFP/contract for the vendor, and/or the data analysis procedures document should be included in the final SIP. It is unclear whether data reports are be submitted by the Department, or directly by the contractor.

- The SIP does not specify requirements for the content (i.e. type of information) in the annual reports. However, the SIP does commit to submit annually: a "Test Data Report", a "Quality Assurance Report", a "Quality Control Report", and an "Enforcement Report". The information to be contained in these reports must be specified in the SIP -- or the contractor RFP detailing this info should be included in the SIP. All reporting should comply with the requirements of 40 CFR 51.366.

**§51.367, Inspector Training and Licensing or Certification**

- Section R (p. 43) of the Commonwealth's SIP narrative contains a commitment to contract with a private vendor who will develop a training program (and assist in the implementation of that training program). This training program description must be submitted as part of the final SIP. If the vendor is to deliver the training program, the Commonwealth should commit to monitor and evaluate the training program.

- The written test for inspectors should be described in the Commonwealth's SIP. Section R of the SIP text describes that the "hands-on" test shall consist of a trainee demonstrating, without assistance, the ability to conduct a proper inspection".

- The actual process of obtaining inspector and station certification/licensing should be clearly set forth in the SIP.

- The SIP should require that re-certification for inspectors be based upon completion of an exam or a refresher training course. §177.408(c)(3) of the PA regulation currently states that re-certification will be based upon procedures to be established by PennDOT.

**§51.368, Public Information and Consumer Protection**

- Section S (p. 44) of the SIP states that the Department will contract with a private vendor to provide public information services. The RFP/contract for this vendor should be included in the final SIP.

- The SIP should include a plan to offer motorists that fail the test repair facility performance data and diagnostic information. Pennsylvania has not addressed this requirement in its present SIP.

- The Commonwealth's draft SIP does not include provisions to protect the public from fraud and abuse by inspectors, mechanics, and others involved in the I/M program. For instance, can the Commonwealth provide information to consumers on how to locate a qualified repair technician? The Commonwealth should be able to provide motorists with information on station repair effectiveness.

- The SIP narrative should contain a description of the public complaint process, and a follow-up process, if a citizen is dissatisfied with testing.

**§51.369, Improving Repair Effectiveness**

- Per EPA requirements, the SIP needs to contain performance monitoring requirements or technical assistance programs for repair technicians. The Commonwealth must ensure that repair technician assistance be available for use by repair technicians.

- The PA SIP does not include provisions for facility performance monitoring, as required by EPA regulation.

**§51.370, Compliance with Recall Notices**

- EPA requires that the Commonwealth establish a process for notifying motorists of specific recall requirements prior to the test deadline. The Commonwealth's SIP states that this is the responsibility of the auto manufacturers, and it will not issue its own notification under the I/M program.

- The Commonwealth's SIP does not specify that the data collection system indicate the recall campaign number for those vehicles in the recall database.

**§51.371, On-road Testing**

- The SIP narrative states that this portion of the SIP will be handled by a private vendor. At this time, neither the contract, nor the RFP have been drafted. No budget has been submitted for this contract, nor has the number of employees dedicated to the on-road testing been specified by the state.

- The Commonwealth's SIP does not commit to conduct the minimum number of on-road tests per test cycle (i.e. 20,000 per year for Pennsylvania's annual program), per the requirements of 40 CFR 51.371. Pennsylvania cannot perform 20,000 on-road tests per biennial time period for an annual inspection program to meet this requirement, as claimed in Section V of the SIP narrative.

**§51.372, State Implementation Plan Submittals**

- The SIP does <u>not</u> include an implementation schedule, including: the program start date(s), dates by which the various RFPs for key program functions will be issued, dates by which contractors are to be hired, dates by which stations must be licensed/obtain equipment, etc.

- The Commonwealth's SIP narrative should clearly set forth implementation schedules for both the high-enhanced and low-enhanced programs. Neither the SIP narrative nor the regulation indicates the official start dates for the programs.

- Pennsylvania has not included schedules for issuance of RFPs for contracting with vendors on various program elements, nor have they issued all necessary procedures documents.

- Since the SIP does not include testing cutpoints, neither does it indicate whether there will be phase-in cutpoints, or when final cutpoints will be effective.

- A list of zip codes for all areas of subject counties should be provided in the SIP.

**§51.373, Implementation Deadlines**

- The SIP does not contain a schedule for adoption/implementation of the program. The actual start date of the program is not clearly stated within the submittal for the National Highway Act submittal.

# ON-BOARD DIAGNOSTICS
# REMOTE SENSING DEVICE

## GENERATION - ONE

BEGINING IN 1980 - CALIFORNIA

1981 - FEDERAL/HIGH ALTITUDE
(FEDERAL - 49 STATES, HIGH ALTITUDE -
4000 FT OR 1200 METERS)

## GENERATION - TWO

CALIFORNIA - 1994

FEDERAL - 1996
(HIGH ALTITUDE INCLUDED WITH
FEDERAL)

David H. Lee
13 Cathy Lane
Aston, PA 19014

# The Role Of Onboard Diagnostics (OBD)

# In Performing Emission Repairs

When a vehicle's fuel management (emission control) computer detects an abnormally occurring condition, it will set a fault code and possibly either (1) illuminate a malfunction indicator (check engine) light, or (2) alter its own fuel management or emission control strategy, or both. These fault codes are the computers only means of communicating that some type of problem has been detected. Fault codes-or conditions under which they are set-vary from manufacturer to manufacturer and from model to model. The process of setting a fault code and illuminating a light is referred to as onboard diagnostics or OBD.

The original intent of these fault codes was to inform the automotive engineers initially designing the system, that a set of undesirable conditions had occurred. As is the fate of all leftover development tools, they became employed as part of the assembly-line test equipment and quality control processes. The term ALDL or Assembly Line Diagnostic Link was first used by GM in the early '80's to describe their interface to the fuel/emission control computer. The use of this diagnostic port and the reliance on the vehicle's computer to perform its own self diagnosis, increasing became a more essential part of the recommended factory service procedures. Ascertaining that the fuel/emissions control computer has detected an abnormal condition is fundamental in resolving any vehicle problem.

OBD will play two essential roles in improving our nation's air quality: (1) as an inspection tool and (2) as a diagnostic and repair tool. As an I/M inspection tool, thus far it has been a disappointment; on the other hand, as a diagnostic and repair tool, it has been an outstanding success. Its failure as an inspection tool is a result of the variety of methods employed by the different vehicle manufacturers in setting OBD codes, retrieving OBD codes, and in illuminating a malfunction indicator light or check engine light when certain codes are set. For example, on some systems;

- Codes are cleared (erased) if the ignition is cycled on and off.
- A check engine light may be illuminated as a service reminder.
- The nomenclature appearing on the malfunction indicator lights is inconsistent, even within a manufacturer's models. Various descriptions include "Check Engine", "Service Engine Soon", "ECS" (Engine Control System), "Power Loss", and "PGMFI," while some vehicles have more than one of these fights.
- Some manufacturers illuminate the check engine light anytime any type of code is set, others light it only when specific emission-related codes are set.

Non-emission related codes are not always differentiated from emission-related codes. Codes for the cruise control, air conditioning, or anti-theft systems, may be intermixed with fuel/emission control system codes.

These variations in implementation between the manufacturers are not readily tolerated by our I/M inspection methods, methods that rely more on regimented procedures and across-the-board standards. Therefore, because of their inconsistencies, the use of the check engine light, or the presence of OBD codes, were essentially written off as official pass/fail inspection tools. When used as a service tool however, OBD has been tremendously successful in aiding repair technicians in diagnosing and repairing fuel management computer malfunctions. The technology in today's microprocessor based tools has sorted out the variations and inconsistencies between the OBD systems, essentially making most of the differences virtually transparent to the technician. This has allowed technicians to take full advantage of the self diagnostic capabilities of the fuel/emission computers. Not using these capabilities would be equivalent to a doctor not asking his patient what additional symptoms are accompanying a high fever. The additional symptoms serve to narrow the possible causes. The doctor doesn't just treat the fever, he treats its causes. Neglecting to use the insight provided by the OBD system, will certainly waste many emission repair dollars.

Not only are today's engine control systems more complex and varied than ever before, they are getting smarter. This makes it increasingly more difficult for a mechanic to second guess what may be causing a particular vehicle symptom to occur. All the systems do not react the same. Each system contains its own unique, built-in alternative strategies for possible failures. The first generation computers, upon detecting a problem, set a code, but continued to use values from the suspicious sensor. Succeeding generations started substituting nominal values, or values from other sensors measuring similar parameters. Today, Ford touts their FEMS or Failure Effects Management System. This system, for example, when detecting an excessively rich running condition, will divert air from being injected into the catalytic converter, thus keeping the converter from performing its intended function. Here, the purpose is to keep the converter from burning up prematurely, before the cause of the problem can be detected and corrected. An emission repair mechanic, however, charged with lowering emission levels, who doesn't customarily pull codes from the computer, might not know that air was intentionally being diverted from the converter. He might solve the emissions problem by hot wiring the air divert solenoid ON. This would serve to lower the emissions levels to pass the test, but defeat the purpose of the emission control system, leading to a more expensive repair down the road. Until the vehicle fails its next biennial inspection, it's a gross polluter. At its next inspection, the vehicle owner would only to need replace the converter. It costs more than $450-and would not be required to fix the original problem.

In conclusion, the best technicians wouldn't think of addressing an emission failure, or a driveability problem for that matter, without first determining if the computer has itself detected a problem. These fault codes are essential to effective diagnosis and repair. While the non-standard OBD might have disappointed a few in the inspection arena, it's utility and necessity should not be overlooked by those involved on the field of I/M repair.

# WHY DO VEHICLES HAVE OBD ?

## I DEFINITIONS

- ON-BOARD DIAGNOSTIC
- OBD AND OBD I
- OBD II

## II. THE "I" INSPECTION SIDE OF OBD

WHY OBD IN THE INSPECTION PROCESS

WHEN OBD WILL BE PERFORMED

TEST RESULTS

## III. "M" MAINTENANCE SIDE OF OBD

WHY OBD IN THE INSPECTION PROCESS

WHEN OBD WILL BE PERFORMED

THE CHALLENGE THAT EXISTS TO UTILIZE OBD IN THE INSPECTION PROCESS

## WHY DO VEHICLES HAVE OBD?

ON-BOARD DIAGNOSTICS WERE FIRST USED BY THE MANUFACTURERS ENGINEERS TO CHECK THE COMPUTER SYSTEMS THEY WERE DESIGNING

THE CALIFORNIA AIR RESOURSES BOARD (CARB) SET MINIMUM STANDARDS, REQUIRING OBD ON VEHICLES SOLD IN CALIFORNIA.

FEDERAL EPA SET FEDERAL STANDARDS FOR THE USE OF ON-BOARD DIAGNOSTICS FOR VEHICLE MANUFACTURERS.

# THE PURPOSE OF OBD

INCREASED CUSTOMER SATISFACTION

LOWER EMISSIONS

SYSTEM PROTECTION

SELF CAMPAIGNING

IMPROVED SERVICE

ASSEMBLY PLANT TESTS

# THE DEFINITION OF ON-BOARD DIAGNOSTICS

THE INTERROGATION OF ENGINE CONTROL SYSTEMS IS PERFORMED BY THE ON-BOARD COMPUTER WHILE THE VEHICLE IS BEING DRIVEN.

THE COMPLETE DIAGNOSTIC SYSTEM ENCOMPASSES THE HARDWARE AND SOFTWARE IN THE CONTROLLER THAT PERFORMS FIVE (5) KEY FUNCTIONS.

FUNCTIONAL MONITORING
FAULT INDICATION OR WARNING
FAULT STORAGE
DEFAULT SUBSTITUTION
COMMUNICATION LINK

## THE DEFINITION OF OFF-BOARD DIAGNOSTICS

OFF-BOARD DIAGNOSTIC SYSTEMS REQUIRE AN EXTERNAL DEVICE TO MONITOR THE VEHICLE ELECTRONIC SYSTEMS AND WATCH FOR SUSPECTED PROBLEMS WHILE THE VEHICLE IS BEING OPERATED.

OFF-BOARD DIAGNOSTIC EQUIPMENT CONNECT TO THE VEHICLE'S ON-BOARD DIAGNOSTIC SYSTEM BY WAY OF THE DIAGNOSTIC CONNECTOR

# ON-BOARD DIAGNOSTICS

## FUNCTIONAL MONITORING

THAT IS THE TRACKING OF THE SYSTEM INPUTS TO VERIFY PROPER SENSOR OPERATION AND INFORMATION CONCERNING THE MONITORING OF THE OUTPUTS AND OVERALL SYSTEM OPERATION IN ORDER TO VERIFY PROPER CONTROLLER OUTPUT OPERATION.

## FAULT INDICATION OR WARNING

IT MUST BE ABLE TO CAUSE THE ILLUMINATION OF THE MALFUNCTION INDICATOR LIGHT (MIL) WHEN A FAULT IS DETECTED.

TO MAINTAIN THE MIL ON FOR THE APPROPRIATE AMOUNT OF TIME AFTER THE FAULT IS DETECTED AND TO TURN OFF THE LIGHT WHEN THE FAULT IS NO LONGER PRESENT-

## FAULT STORAGE

THE DIAGNOSTIC SYSTEM HAS THE ABILITY TO ASSIGN A "FAULT CODE" TO THE PARTICULAR FAULT DETECTED AND STORE THIS CODE UNTIL A SERVICE TECHNICIAN CAN ATTEND TO THE VEHICLE.

## DEFAULT SUBSTITUTION

THE ABILITY TO SUBSTITUTE DEFAULT PARAMETERS WHEREVER APPROPRIATE WHEN A FAULT IS DETECTED OR TO PROVIDE BACK-UP CONTROL *OF* A SYSTEM, IF DEEMED NECESSARY-

## COMMUNICATION LINK

PROVIDE THE ABILITY TO COMMUNICATE DIAGNOSTIC INFORMATION TO OFF-BOARD SYSTEMS WHEN REQUIRED.

## OBD AND OBDI

VERY SOPHISTICATED SYSTEMS WERE NEEDED ACCURATELY CONTROL ALL OF THE ENGINE OPERATING PARAMETERS THAT EFFECT EMISSIONS.

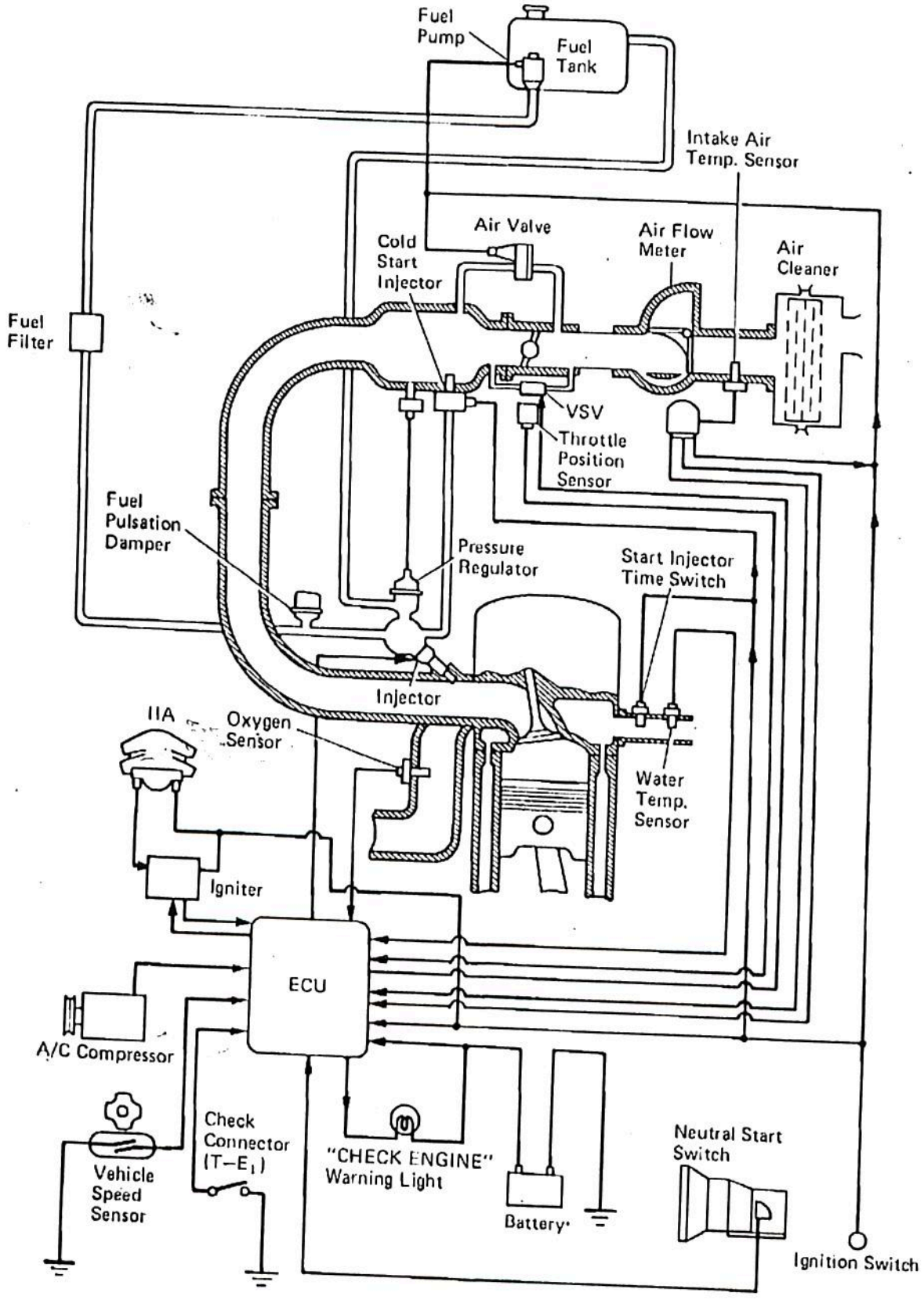
# OBJECTIVE

- STORE TROUBLE CODES
- ILLUMINATE "CHECK ENGINE" LIGHT
- MONITOR SENSOR INPUT LIMITS FOR PROPER OPERATION -
- MONITOR SELECT OUTPUTS FOR LIMITS FOR PROPER OPERATION
- OBD AND OBD-I HAD A ESTIMATED AVERAGE OF 10 TO 20 FAULT CODES TO HELP TECHNICIANS DIAGNOSIS EMISSION/ENGINE MANAGEMENT PROBLEMS IN ORDER TO PERFECT REPAIR TECHNIQUES ON THE AFFECTED VEHICLES-

# EXAMPLE

## 1981 GM 2.OL 4 CYLINDER ENGINE
## FAULT CODES

12 NO REFERENCE PULSES
13 OXYGEN SENSOR
14 COOLANT TEMPERATURE INPUT HIGH
15 COOLANT TEMPERATURE INPUT LOW
21 THROTTLE POSITION INPUT HIGH
23 CARBURETOR SOLINOID LOW
24 VEHICLE SPEED SENSOR
32 BAROMETRIC PRESSURE INPUT LOW
34 PRESSURE SENSOR INPUT ERROR
35 THROTTLE SWITCH ERROR
41 NO REFERENCE PULSES WHILE RUNNING
42 IGNITION MODULE ERROR
43 ESC RETARD SIGNAL ERROR
44 LEAN OXYGEN SENSOR
51 PROM ERROR
52 ECM MEMORY ERROR
54 CARBURETOR SOLENOID DRIVER ERROR




System Diagram

**Computers and Control Systems: Electrical Diagrams**
**System Diagram**

# ON-BOARD DIAGNOSTICS GENERATION II (OBD II)

# COMPREHENSIVE COMPONENT MONITORING

## A. INPUT COMPONENTS

THE DIAGNOSTIC SYSTEM SHALL MONITOR FOR MALFUNCTION ANY ELECTRONIC POWERTRAIN COMPONENT/SYSTEM WHICH CAN EFFECT EMISSIONS NOT OTHERWISE DESCRIBED.

## B. OUTPUT COMPONENTS

THE DIAGNOSTIC SYSTEM SHALL MONITOR FOR PROPER FUNCTIONAL RESPONSE OF ANY POWERTRAIN OUTPUT COMPONENT/SYSTEM WHICH CAN EFFECT EMISSIONS.

## C. COMPONENTS/SYSTEM

SHALL BE MONITORED CONTINUOUSLY

# TAMPERING PROTECTION

COMPUTER-CODED ENGINE OPERATING PARAMETERS SHALL NOT BE CHANGEABLE WITHOUT THE USE OF SPECIALIZED TOOLS AND PROCEDURES. ANY REPROGRAMMABLE COMPUTER CODE SYSTEM (E.G.EEPROM) SHALL INCLUDE PROVEN WRITE-PROTECT FEATURES...

## READINESS/FUNCTION CODE

IF A FULL DIAGNOSTIC CHECK OF ALL MONITORED COMPONENTS AND SYSTEMS HAS NOT BEEN COMPLETED SINCE THE COMPUTER MEMORY WAS LAST CLEARED, A CODE SHALL STORE INDICATING THE NEED FOR ADDITIONAL MIXED CITY AND HIGHWAY DRIVING TO COMPLETE THE CHECK. THE DIAGNOSTIC SYSTEM SHALL ALSO INCLUDE A CODE OR ACKNOWLEDGE MESSAGE INDICATING THAT THE DIAGNOSTIC SYSTEM ITSELF IS FUNCTIONING PROPERLY.

## EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING

A. THE DIAGNOSTIC SYSTEM SHALL MONITOR THE EGR SYSTEM ON VEHICLES SO EQUIPPED FOR LOW AND HIGH FLOW RATE MALFUNCTIONS.

B. THE EGR SYSTEM WILL BE CONSIDERED MALFUNCTIONING WHEN THE FLOW RATE CAUSES VEHICLE EMISSIONS TO EXCEED 1.5 TIMES ANY APPLICABLE FTP STANDARD.

## OXYGEN SENSOR MONITORING

A. ALL OXYGEN SENSOR OUTPUT VOLTAGE, RESPONSE RATE AND ANY OTHER PARAMETER WHICH CAN AFFECT EMISSIONS WILL BE MONITORED FOR MALFUNCTION

B. AN OXYGEN SENSORWILL BE CONSIDERED MALFUNCTIONING WHEN THE VOLTAGE, RESPONSE RATE, OR OTHER CRITERIA ARE EXCEEDED AND CAUSES EMISSIONS TO EXCEED 1.5 TIMES ANY APPLICABLE FTP STANDARDS.

## MISFIRE DETECTION

A. THE DIAGNOSTIC SYSTEM SHALL MONITOR ENGINE MISFIRE AND SHALL IDENTIFY SPECIFIC CYLINDER EXPERIENCING MISFIRE.

B. MONITORING CONDITIONS FOR 1997 AND LATER VEHICLES WILL BE CONTINUOUS AND UNDER ALL POSITIVE TORQUE ENGINE SPEEDS AND CONDITIONS.

C. FOR PRE-1997 VEHICLES,MISFIRE SHALL BE MONITORED CONTINUOUSLY DURING POSITIVE TORQUE CONDITIONS WITHIN THE RANGE OF ENGINE SPEED AND LOAD CONDITION COMBINATIONS ENCOUNTERED DURING AN FTP TEST.

## CATALYST MONITORING

A. THE DIAGNOSTIC SYSTEM WILL MONITOR THE CATALYTIC CONVERTER(S) FOR PROPER PERFOMANCE.

THE CATALYST SHALL BE CONSIDERED MALFUNCTIONING WHEN TOTAL HYDROCARBON (HC) CONVERSION EFFICIENCY FALLS BETWEEN 50 TO 60 %.

B. A CATALYST MONITORING CHECK SHALL OCCUR AT LEAST ONCE PER TRIP.

C. MONITORING OF THE HEATED CATALST SYSTEM IS THE SAME.

## SECONDARY AIR SYSTEM MONITORING

A. ANY VEHICLE EQUIPPED WITH ANY FORM OF SECONDARY AIR DELIVERY SYSTEM SHALL HAVE THE DIAGNOSTIC SYSTEM MONITOR THE PROPER FUNCTIONING OF THE SECONDARY AIR DELIVERY SYSTEM AND ANY AIR SWITCHING VALVE.

## UEL SYSTEM MONITORING

A. THE DIAGNOSTIC SYSTEM SHALL MONITOR THE FUEL DELIVERY SYSTEM SUCH THAT A VEHICLE'S EMISSIONS WOULD NOT EXCEED 1.5 TIMES ANY OF THE APPLICABLE FTP STANDARDS BEFORE A FAULT IS DETECTED.

B. THIS MONITORING SHALL OCCUR CONTINUOUSLY. THE MIL SHALL BE ILLUMINATED AND A FAULT CODE STORED NO LATER THAN THE END OF THE NEXT DRIVING CYCLE IN WHICH THE CRITERIA AND INTERVAL ARE AGAIN EXCEEDED.

## AIR CONDITIONING SYSTEM REFRIGERANT MONITORING

A. THE DIAGNOSTIC SYSTEM SHALL MONITOR AIR CONDITIONING SYSTEMS FOR LOSS OF REFRIGERANTS WHICH COULD HARM THE STRATOSPHERIC OZONE LAYER OR ARE REACTIVE IN FORMING ATMOSPHERIC OZONE.

B. THE DIAGNOSTIC SYSTEM SHALL MONITOR THE AIR CONDITIONING SYSTEM AT LEAST ONCE PER TRIP.

## EVAPORATIVE SYSTEM MONITORING

A. THE DIAGNOSTIC SYSTEM SHALL VERIFY AIR FLOW FROM THE COMPLETE EVAPORATIVE SYSTEM.

B. AN EVAPORATIVE SYSTEM SHALL BE CONSIDERED MALFUNCTIONING WHEN NO AIR FLOW FROM THE SYSTEM CAN BE DETECTED,OR WHEN A SYSTEM LEAK IS DETECTED.

OBD-II

## DTC Format

Diagnostic Trouble Codes for EEC-V are formatted according to SAE J2012. SAE J2012 dictates a five-digit alphanumeric DTC with each digit defined as follows:

- Prefix letter of DTC indicates DTC function:
  - P — Powertrain
  - B — Body
  - C — Chassis
- First number indicates who was responsible for DTC definition:
  - 0 — SAE
  - 1 — Manufacturer
- Third digit of powertrain DTC indicates subgroup:
  - 0 — Total System
  - 1 — Fuel/Air Control
  - 2 — Fuel/Air Control
  - 3 — Ignition System/Misfire
  - 4 — Auxiliary Emission Controls
  - 5 — Idle/Speed Control
  - 6 — PCM and I/O
  - 7 — Transmission
  - 8 — Non-EEC Powertrain
- The fourth and fifth digit specify the area involved.

Let's take a possible DTC and break it into defined segments.

For Example: P1711

- P — First digit letter indicates a Powertrain DTC.
- 1 — Second digit indicates a manufacturer defined DTC.
- 7 — Third digit indicates a transmission sub-group concern.
- 11 — Fourth and fifth digits indicate a TOT Circuit out of range.

| DTC | Circuit Or Condition |
|---|---|
| P1133 | HO2S/O2S Insufficient Switching Sensor 1 |
| P1134 | HO2S Transition Time Ratio Sensor 1 |
| P1139 | HO2S Insufficient Switching Bank 1 Sensor 2 |
| P1140 | HO2S Transition Time Ratio Bank 1 Sensor 2 |
| P1153 | HO2S Insufficient Switching Bank 2 Sensor 1 |
| P1154 | HO2S Transition Time Ratio Bank 2 Sensor 1 |
| P1171 | Fuel System Lean During Acceleration |
| P1187 | EOT Sensor Circuit Low Voltage |
| P1188 | EOT Sensor Circuit High Voltage |
| P1200 | Injector Control Circuit |
| P1214 | Injection Pump Timing Offset |
| P1216 | Fuel. Solenoid Response Time Too Short |
| P1217 | Fuel. Solenoid Response Time Too Long |
| P1218 | Injection Pump Calibration Circuit |
| P1222 | Injector Control Circuit Intermittent |
| P1250 | Early Fuel Evaporative Heater Circuit |
| P1257 | Supercharger System Overboost |
| P1258 | Engine Metal Over Temperature Protection |
| P1275 | Boost Control Problem |
| P1300 | Ignition Control Module Circuit |
| P1320 | ICM 4X Reference Circuit Too Many Pulses |
| P1323 | ICM 24X Reference Circuit Low Frequency |
| P1345 | CKP Sensor/CMP Correlation |
| P1350 | Ignition Control System |
| P1351 | Ignition Control Circuit High Voltage |
| P1361 | IC Circuit Not Toggling |
| P1361 | Ignition Control Circuit Low Voltage (Distributor Ignition) |
| P1370 | ICM 4X Reference Too Many Pulses |
| P1371 | ICM 4X Reference Too Few Pulses |
| | Distributor Ignition Low Resolution Circuit |
| P1374 | 3X Reference Circuit |
| P1375 | ICM 24X Reference Voltage Too High |
| P1376 | Ignition Ground Circuit |
| P1377 | ICM Cam Pulse To 4X Reference Pulse Comparison |
| P1380 | Electronic Brake Control Module DTC Detected/Rough Road Data Unusable |
| P1381 | Misfire Detected No EBCM/PCM Serial Data |
| P1403-P1405 | EGR Error |
| P1406 | EGR Valve Pintle Position Circuit |
| P1408 | MAP Sensor Circuit |
| P1410 | Fuel Tank Pressure System |
| P1415 | AIR System Bank 1 |
| P1416 | AIR System Bank 2 |
| P1441 | EVAP System Flow During Non-Purge |
| P1442 | EVAP Vacuum Switch Circuit |
| P1450 | BARO Sensor Circuit |
| P1451 | BARO Sensor Circuit |
| P1460 | Cooling Fan Circuit |
| P1500 | Starter Signal Circuit |
| P1508 | IAC System Low RPM |
| P1509 | IAC System High RPM |
| P1510 | Backup Power Supply |
| P1520 | Park/Neutral Position Switch Circuit |
| P1524 | TPS Learned Closed Throttle Angle Degrees Out Of Range |
| P1526 | TPS Learn Not Completed |

| DTC | Circuit Or Condition |
|---|---|
| P1530 | Ignition Timing Adjustment Switch Circuit (2) |
| | A/C Refrigerant Pressure Sensor Error |
| P1532 | A/C Evaporator Temperature Circuit Low Voltage |
| P1533 | A/C Low Side Temperature Sensor Circuit |
| P1535 | A/C High Side Temperature Sensor Circuit |
| P1536 | A/C System ECT Over Temperature |
| P1537 | A/C Request Circuit Voltage Low |
| P1538 | A/C Request Circuit Voltage High |
| P1539 | A/C High Pressure Switch Circuit High Voltage |
| P1540 | A/C System High Pressure |
| P1542 | A/C System High Pressure/High Temperature |
| P1543 | A/C System Performance |
| P1545 | A/C Clutch Relay Control Circuit |
| P1546 | A/C Clutch Relay Control Circuit Low Voltage |
| P1550 | Stepper Motor Cruise Control |
| P1554 | Cruise Control Status Circuit |
| P1558 | Cruise Control (SPS Low) |
| P1560 | Cruise Control System/Transaxle Not In Drive |
| P1561 | Cruise Control Vent Solenoid |
| P1562 | Cruise Control Vacuum Solenoid |
| P1564 | Cruise Control System/Vehicle Acceleration Too High |
| P1565 | Cruise Control Servo Position Sensor |
| P1566 | Cruise Control System/Engine RPM Too High |
| P1567 | Cruise Control Switches |
| P1568 | Cruise Control (SPS High) |
| P1570 | Cruise Control System/Traction Control Active |
| P1571 | TCS Desired Torque Circuit |
| | Traction Control System PWM Circuit No Frequency (3) |
| P1572 | Traction Control System Active Circuit Low Voltage Too Long |
| P1573 | PCM/EBTCM Serial Data Circuit |
| | Engine Hot Lamp Control Circuit (4) |
| P1574 | EBTCM System/Stop Lamp Circuit High Voltage |
| P1575 | Extended Travel Brake Switch Circuit High Voltage |
| P1576 | Brake Booster Vacuum Sensor Circuit High Voltage |
| P1577 | Brake Booster Vacuum Sensor Circuit Low Voltage |
| P1578 | Brake Booster Vacuum Sensor Circuit Low Vacuum |
| P1579 | Park/Neutral To Drive/Reverse At High Throttle Angle |
| P1599 | Engine Stall Or Near Stall Detected |
| | Cruise Control Management (5) |
| P1600 | PCM Battery |
| | Serial Communication Between PCM & TCM |
| P1601 | Loss Of Serial Communication |
| P1602 | Loss Of EBTCM Serial Data |
| P1603 | Loss Of SDM Serial Data |
| P1604 | Loss Of IPC Serial Data |
| P1605 | Loss Of HVAC Serial Data |
| P1610 | Loss Of PZM Serial Data |
| P1611 | Loss Of CVRTD Serial Data |
| P1619 | Engine Oil Life Monitor Reset Circuit |
| P1621 | PCM Memory Performance |
| P1623 | PROM Error |
| P1626 | Theft Deterrent System Fuel Enable Circuit |
| P1627 | A/D Performance |
| P1629 | Theft Deterrent System Fuel Enable Circuit Incorrect Signal Detected During Engine Cranking |
| P1630 | Theft Deterrent System/PCM In Learn Mode (2) |
| | System Voltage Error |

*Continued*

Typical Codes
OBD - II

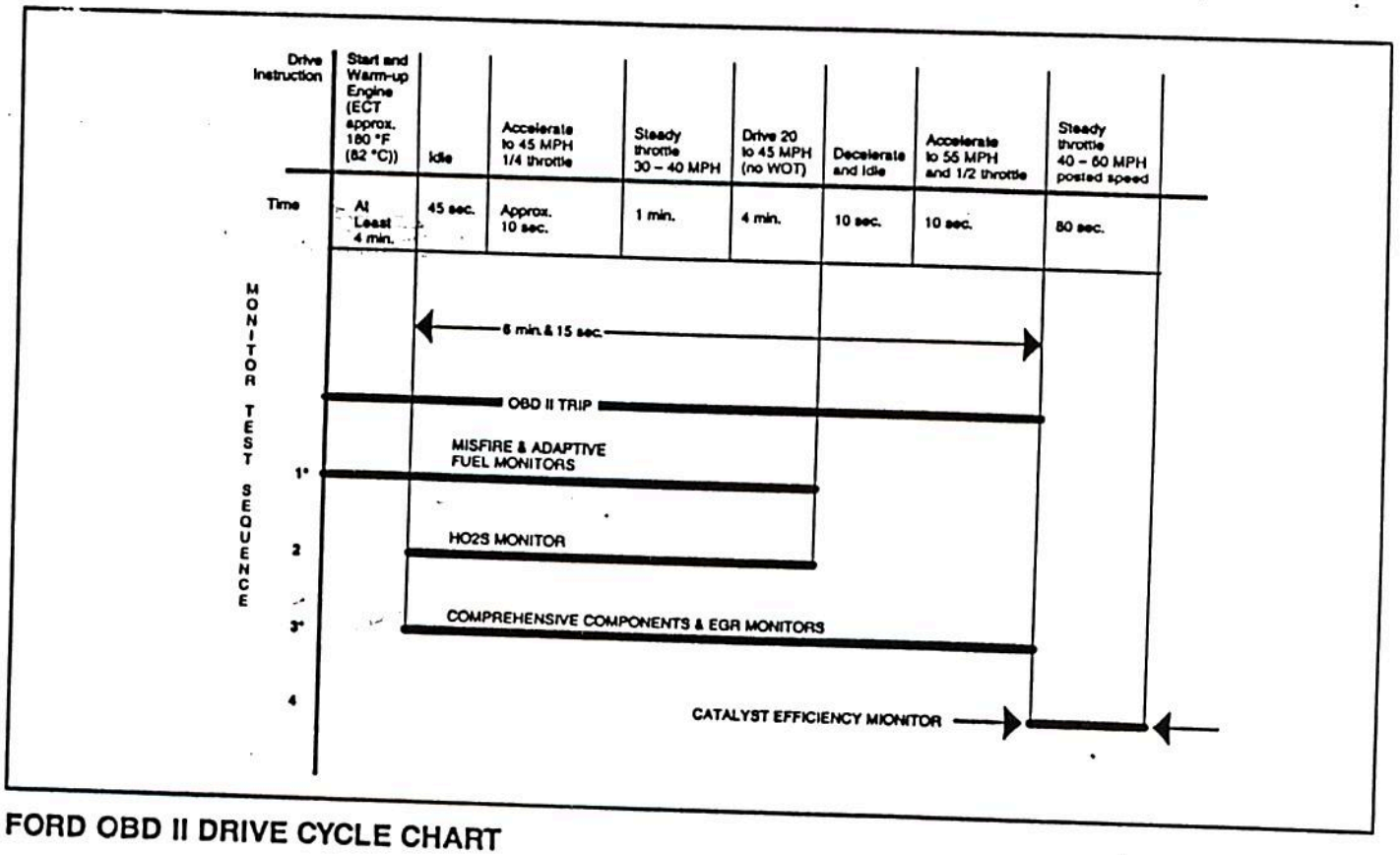
## Ford OBD II Drive Cycle Definition

The Ford OBD II Drive Cycle is a specific driving pattern used to include all Trip Monitor tests plus the Catalyst Efficiency Monitor Test. Refer to Drive Cycles (Diagnostic Methods, PC/ED Section 2) for detailed instruction.

Ford OBD II Drive Cycle requirements include:

- All Trip monitors completed.
- The Catalyst Efficiency Monitor requires a steady drive mode (40 to 60 MPH) for a period of time beyond the completed HO2S Monitor test. The Catalyst Efficiency Monitor test must be completed after the Trip requirement of the Drive Cycle.

The following chart shows the Ford OBD II Drive Cycle.




**FORD OBD II DRIVE CYCLE CHART**

### INFORMATION HIGHLIGHTS

- **An OBD II Drive Cycle is required to allow all EEC-V tests and monitors to function.**

# REMOTE SENSING

## APPLICATIONS

The Remote Smog Detector (RSD-1000) is being commercialized to complement and enhance State emission testing programs.

Potential applications include:

### *Random Inspection*

The unit monitors vehicles and identifies gross emitters of CO or HC. The high emission readings are retained on VCR or computer disks with the photo of the vehicle, its license number, CO value, HC value, time and date.

### *Tamper Inspection*

Vehicles with high levels of HC or CO may be selected to be pulled over for on-road tamper inspection by law enforcement agents.

### *Mass Data Collection*

With the ability to monitor and capture data on up to 1000 vehicles per hour the RSD-1000 is ideally suited for gathering fleet data for analysis purposes e.g., age of vehicles, types of vehicles, geographic source of vehicles, emissions levels versus various parameters such as time, temperature, etc.

### *Hot Spot Inspection*

Vehicles in "Hot Spot" areas can be monitored to identify gross emitters.

### *Attainment Monitoring*

Once an area has achieved the air quality objective, the RSD-1000 can be used to gather mass fleet data. These data can be compared to future or past data to identify trends or changes in vehicle emissions and air quality.

### *Traffic Signal Setting*

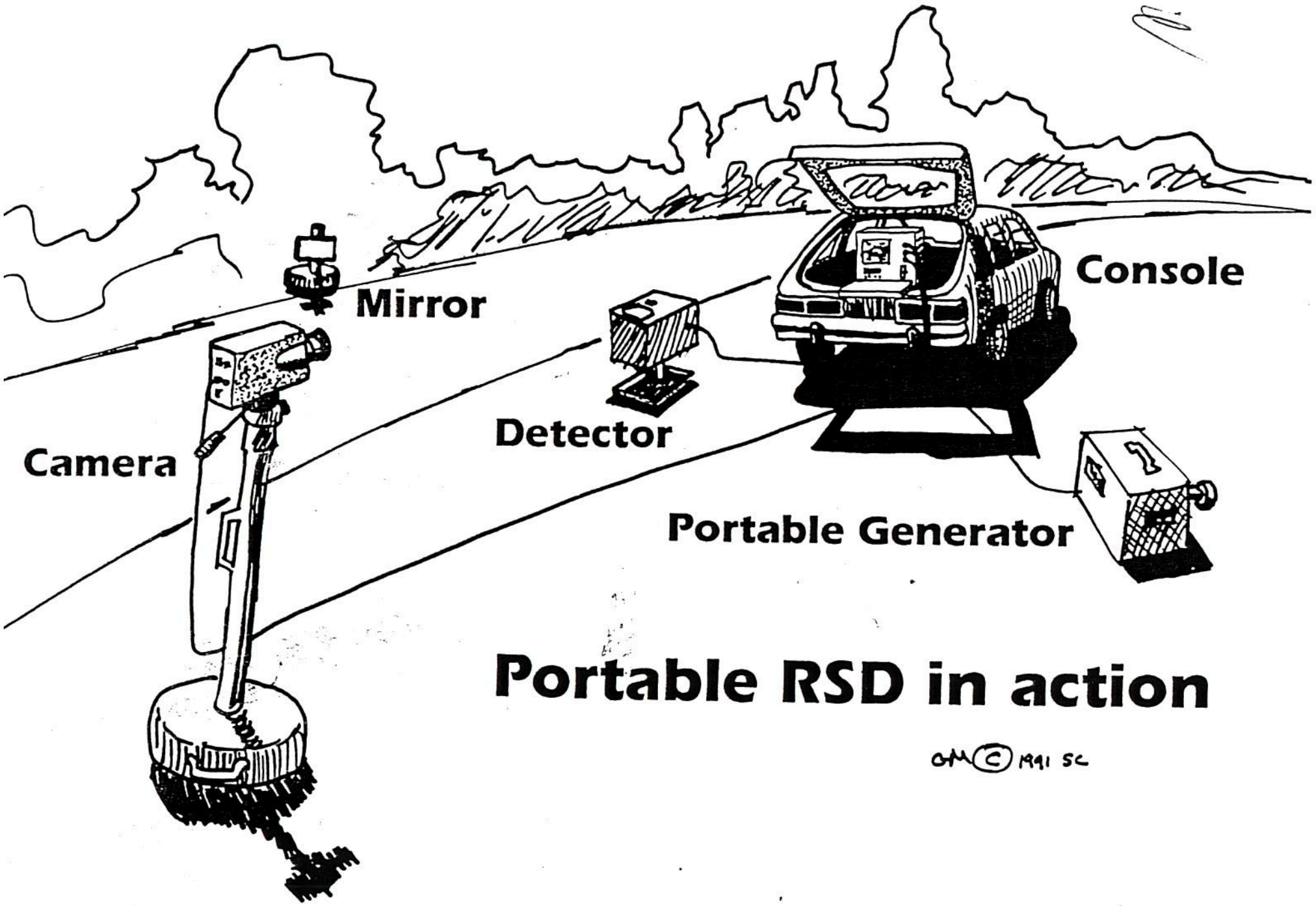
Traffic signal timing and throughway on-ramp gates can use data from a RSD-1000 to optimize the switching frequency to minimize emissions concentration.

### *Entrance/Access Limitation*

Vehicles with gross emissions levels could be prohibited from entering tunnels or sensitive areas.

### *Driver Information*

Emission levels could be monitored on the highway and displayed on lighted panels as acceptable or high. This would alert the driver to potential vehicle problems that may be contributing to poor fuel economy and high emissions.




# Portable RSD in action